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Claims

1. A process in which a hydroxyl-substituted organic compound selected from the formulae R_1CH_2OH , R^1R^2CHOH and $R^1R^2R^3COH$ is exposed, optionally in the presence of one or more further organic compounds selected from second hydroxyl-substituted organic compounds of the formulae R^4CH_2OH , R^5R^6CHOH , and $R^7R^8R^9COH$ and carbonyl compounds of the formula $R^{10}R^{11}CO$, to a heterogeneous catalyst which is able to provide a source of acid in a continuous flow reactor under supercritical conditions or at near-critical conditions for the fluid that is acting as solvent, with the result that an ether is formed from two hydroxyl-substituted organic compound molecules in a dehydration reaction, an acetal or ketal is formed by reaction between a hydroxyl-substituted organic compound molecule and a molecule of a said carbonyl compound and an alkene product is produced by dehydration of a single hydroxyl-substituted organic compound molecule, wherein the conditions of temperature, pressure, and flow rate are controlled according to the product to be obtained, and wherein each of R^1 to R^{11} is independently selected from: hydrogen or hydroxyl; an optionally substituted alkyl, alkenyl, alkynyl, aralkyl, cycloalkyl, cycloalkenyl, or aryl; or a heterocyclic group.

2. A process according to claim 1, wherein each of R^1 to R^{11} when present is an optionally substituted alkyl group.

3. A process according to claim 2, wherein each of the alkyl groups independently contains not more than 10 carbon atoms in the carbon chain (excluding optional substituents if present).

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4. A process according to claim 1, 2 or 3, wherein the total number of alcohol groups within the organic compound does not exceed three.

5 5. A process according to any preceding claim, wherein the reaction is performed under supercritical conditions.

10 6. A process according to any preceding claim, wherein the organic compound of formula R^1CH_2OH , R^1R^2CHOH or $R^1R^2R^3COH$, and optionally one or more of the compounds of formulae R^4CH_2OH , R^5R^6CHOH , $R^7R^8R^9COH$ or $R^{10}R^{11}CO$, is dissolved in a fluid selected from: carbon dioxide, propane, an alkene, an alkyne, 15 hydrocarbon, halocarbon, nitrogen, or a mixture of any of these.

20 7. A process according to any one of claims 1 to 5, wherein the organic compound is the supercritical or near-critical fluid.

25 8. A process according to any preceding claim, wherein the catalyst is selected from: zeolites, metal oxides, molecular sieves, clays, or sulfonic acid derivatives.

9. A process according to claim 8, wherein the catalyst is supported on an inert carrier.

30 10. A process according to claim 8 or 9, wherein the catalyst includes a promoter.

35 11. A process according to any of claims 8, 9 or 10, wherein the acidity of the catalyst is provided by a sulfonic acid group.

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12. A process according to any preceding claim, wherein the reactant molecules are aliphatic and/or aromatic alcohols.

5 13. A process according to any preceding claim, in which the product is an ether.

10 14. A process according to claim 13, in which the reactant(s) and the product are straight-chain n-alkyl molecules.

15 15. A process according to claim 11 or 12, wherein an aliphatic alcohol is converted into an alkene.

16. A process according to any preceding claim, in which the reactant(s) form a single homogeneous phase.